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Addressing the Gender Workforce Gap in the Scientific Journal Editorial Hierarchy

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Addressing the Gender Workforce Gap in the Scientific Journal Editorial Hierarchy

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Table of Contents

1. Introduction

A gender gap in the field of science is not uncommon when considering the sociological, economic, and historical background of gender roles and careers in most societies. Many efforts are being made to engage young women and girls in careers in science. However, there is a concern as women experience a halt in their career progression and job promotions in different fields of science.

The Gender Policy Committee of the European Association of Science Editors (EASE) conducted an international survey in 2013 to map existing editorial policies aimed to address sex and gender disparities in a variety of academic journals[1]. The results revealed little evidence of scientific journals considering the importance of sex and gender issues[2]. The overall proportion of respondents who reported having sex/gender policies at their journals was very low, ranging from 0 to 15% depending on the sample and the policy area[2]. The Committee made recommendations (Appendix A) in response to a need for a common standard, since many journals were found not to have detailed or systematic policies or procedures regarding sex and gender-specific reporting of scientific research. Many journals also lacked stated aims and procedures to promote gender balance in the management of their journals. Assessing the current gender workforce gap and ways to alleviate the disparity may lead to a more gender-balanced science structure, ultimately benefiting science and innovation as a whole.

The aims of this thesis research project were to (1) document the gender gap in journals in the addiction field; (2) explore whether journals belonging to the International Society of Addiction Journal Editors (ISAJE) and non-editors' society members differ with respect to gender disparities in the editorial hierarchy; and (3) evaluate editors'

attitudes and intentions towards gender balance. Gender audits were conducted for addiction journals which are members of ISAJE. It is important to note that these journals identify as English language journals. Addiction journals were selected over other fields of science and social science because of the thesis director's work with an international society of journal editors and his access to this particular area of science. A gender audit is an analysis of the gender of staff throughout the editorial hierarchy conducted to determine the proportions of men and women affiliated with the peer review process of a scientific journal. The audits conducted were analyzed for evidence of a gender disparity within each group in the editorial hierarchy. A survey was conducted (Appendix B) and used to correlate attitudes with policy commitments towards gender balance.

2. Background and Significance

2.1 Basic definitions of terms

The descriptive term "sex" refers to a set of biological attributes in humans and animals associated with physical and physiological features. This term takes into consideration chromosomes, gene expression, hormone function, and reproductive/sexual anatomy[3]. The categories usually considered are female or male, however, there is variation in the biological attributes that comprise sex and how those attributes are expressed.

Gender is socially constructed and takes into consideration identities of girls, boys, women, men, and gender diverse people[3]. Gender influences self-perception, perceiving others, behavior and interaction across the spectrum of gender, and the distribution of power and resources in society. Gender is commonly, and incorrectly,

conceptualized categorically as a binary (girl/woman and boy/man). It must be noted that there is immense diversity in individual gender expression, understanding, and experience.

2.2 The Gender Gap in Science

The scientific hierarchy is dominated by men, a gender gap that has existed since the beginning of modern science. In an analysis of the eight million scholarly articles collected by JSTOR, it was found that since 1667, only 22 percent of all authors were women, and they were less likely than men to be listed as first authors[4]. The proportion of workforce in different scientific fields varies significantly according to gender. The number of women in science and engineering is growing, yet men continue to outnumber women, especially at the upper levels of these professions[5]. Men publish more papers on average than women[6] and are more likely to publish research in molecular and cell biology, medicine, and economics while women are more likely to publish in humanities and social sciences[4]. Explanations for these differences among scientific fields involve historical, socioeconomic, and structural factors that represent both institutional and personal biases. It is common knowledge that women have been historically discouraged from partaking in STEM, socioeconomically been too disadvantaged to pursue in STEM, and structurally excluded from studying STEM.

An editorial published by *Nature* stressed a need to reflect on women's contributions to science and scientific journals[7]. What is important to note about this editorial is *Nature's* critical lens focusing on women's participation as editors within their own journal. Of *Nature's* 70 editors and reporters who commission, select, write, and oversee their content, 54% are women[7]. They admit their performance as editors is much

less balanced; of the 5,514 people who assessed papers submitted in 2011, 14% were women[7]. By addressing these biases and encouraging equal participation of both men and women throughout the scientific disciplines, science can benefit by a possible increase in novel ideas for research and innovation[8]. In addition, journals can benefit from ensuring recruitment and selection of gender-balanced editorial boards, staff, and peer reviewers so that these novel ideas for research and innovation are published and shared with the greater scientific community.

2.3 The "Leaky Pipeline"

The phenomenon called the "leaky pipeline" refers to an important source of gender bias in the reporting of research. As of 2011: (1) half of all MD degrees, (2) 52% of PhDs in life sciences, (3) 57% of PhDs in social sciences, (4) 71% of PhDs in psychology, and (5) 77% of Doctors of Veterinary Medicine (DVMs) were awarded to women[9]. The proportion of female graduate students and post-doctoral students in most fields of science is higher than it has ever been[10]. However, further along the scientific career path, women are increasingly under-represented; which represents a "leak" in the academic/scientific career pipeline. Women are under-represented in the number of tenured professors as well as the ranks of editors, authors and reviewers as a result of this leak[9]. The proportion of women identified as first and senior authors of research that was published in leading medical journals has increased between 1970 and 2004; but two studies have reported that women are still a minority when it comes to authorship in 6 prominent medical journals with first author proportions of women ranging from 23.7% to 46.7%[11, 12]. The enrollment of students in higher education is not the problem: the Organization for Economic Co-operation and Development (2012) reports more female

students entering academia than men in all but four countries (Germany, Turkey, Korea, and Japan)[13]. Disparities are seen further along the pipeline: women leave the field of research at a higher rate than men, providing greater opportunities for men to progress through the hierarchies[14]. There are few female full time professors, and gender inequalities exist in hiring[7], earnings[15], funding[15], satisfaction[16], and patenting[17]. The proportion of women who are authors of editorials, peer-reviewers, editors-in-chief and editorial board members are similarly low. Only 14% of *Nature's* peer reviewers were women[7]. In 2011, women represented only 15.9% of editors-in-chief of 60 major medical journals and not even a fifth of editorial boards (17.5%)[18].

2.4 Gender diversity improves group collaboration

There is more to promoting gender equity than a moral duty. Promoting the role of women in Science, Technology, Engineering, and Mathematics (STEM) can have positive effects on scientific productivity by enhancing the quality of collaboration in team settings[19]. One study found that gender diversity increased constructive group processes[20]. In comparing all-female versus all-male groups, the former demonstrated more egalitarian behaviors like equal amounts of communication among group members and shared leadership[21]. The positive effects of gender diversity on group processes are relevant to scientific teams because scientific discoveries are increasingly the products of team collaboration[22]. When evaluating the gender gap in STEM, examining the number of women in a particular institution or role will not suffice in order to reap the rewards of gender diversity. It would be most beneficial to ensure that women are represented in collaborative scientific teams at parity to men[19].

2.5 Audits, reporting requirements, and related awareness building tools

Gender audits and reporting requirements are new tools that could be useful in promoting gender equity. Audits in regards to a different disparity (i.e., cultural diversity) were found to create change at the University of Connecticut Health Center (UCHC). The UCHC entered into a three year grant agreement with the Connecticut Health Foundation to increase diversity in its workforce and student body by conducting a cultural audit in 2006[23]. The cultural audit results led to a subsequent strategic plan and commitment to cultural competency[23].

In a study that sought to determine the relationship between gender disparities in scholarly communication, the concept of a gender audit was used; it was called "Name-Gender Assignment"[14]. The authors of the study were interested in the gender of each author on each published paper, but not how many papers were authored by the author[14]. Their analysis was on the aggregate level: how many papers had a female or male author.[14] First names were the primary unit of analysis[14]. The audit has proven to be a useful tool and thus has the potential to create change in the journal editorial hierarchy.

2.6 Policy change is not uncommon and has produced change

Even with gender representation improving for women in science, these improvements often occurred due to changes in policies and procedures. A 1993 mandate by the US National Institutes of Health required research grant applicants and grant recipients to document the proportions of women recruited in clinical research[16]. In 2013, the European Commission committed to upholding a quota to ensure women comprise at least 40% of its funding advisory board for 2014-20[18]. The Nordic countries and Austria also have quotas mandating at least 40% of each gender composing the administrative parts of research organizations[18]. Continuing the trend in 2013, the German Leibniz

Association, a high- profile umbrella organization of 86 non-university research institutions, introduced binding, merit-based quotas to encourage equal opportunities[18]. The quotas specifically used a "cascade model"; each level of academic hierarchy in each discipline must reach at least the same proportion of women that is present at the level below by 2017[18]. These quotas are flexible and thus sensitive to varying numbers of men and women in the various scientific disciplines[18].

Women have been suggested to be risk averse and suffer from a lack of established professional networks[24]. Thus, research institutions should consider the composition of research teams in terms of gender inclusivity and gender balance in tasks and specializations[12]. There is a need for research which examines the ways in which policies that promote collaboration could be a useful tool in addressing gender disparities[24].

2.7 The role of the social sciences in the promotion of gender equity

There are differences in attitudes and awareness regarding issues of social justice between different fields of science. With a tendency for awareness regarding influences of implicit bias and other systematic barriers to equality, the social sciences seem to be the most likely to be gender-balanced scientific fields. A major part of scientific research (and subsequently publishing) depends on the receipt of competitive grants[25]. In the biomedical sciences, for example, women experience a lower funding rate than men in the United States[26] and the United Kingdom[27]. The trends for submitting grant applications and receiving funding are as follows: (1) for the physical sciences and engineering, women submit 17% and receive 15%, (2) the life sciences, 30% and 21%, (3) the social sciences and humanities, 36% and 31%[28]. Social scientists have long

disrupted male dominated hierarchies by engaging with feminist research-management practices with guiding principles of consultation, collaboration and social equality[29]. The ingrained, institutionalized male culture of academia has prompted critiques of knowledge creation that exclude women as researchers and participants. These critiques have raised awareness of this culture in men in the social sciences[29]. There is an awareness that is taking longer to permeate science, technology, engineering, and mathematics (STEM) disciplines[27].

3. Research Objectives

The first aim of this research study was to identify the extent to which the editorial hierarchy in addiction journals is gender-balanced. This study predicted that the gender disparity within the peer review structure of scientific journals publishing addiction science will be greatest at the higher levels (e.g., editor, assistant editor, editorial advisory board) and smaller at the lowest levels (e.g., secondary and primary authors). This study also hypothesized that editors who are members of an editors' society that has endorsed the Sex and Gender Equity in Research (SAGER) guideline will be more likely to have a balanced editorial hierarchy than editors who are not members of such a society. The SAGER guideline (Appendix C) is a comprehensive procedure for the reporting of sex and gender data in study design, data analyses, results and interpretation of findings. It is designed primarily to guide authors in manuscript preparation; however, it also encourages editors to integrate the assessment of sex and gender in manuscripts as an important part of the editorial process.

The second aim of this research was to determine whether membership in an editors' society contributes to a consideration of policy change regarding sex, gender, and sexism in the editorial hierarchy of scientific journals. An editors' society can be defined as a group of journal editors who network and collaborate to improve scientific publishing practices within or across disciplines. Membership in an editors' society is hypothesized to reduce gender disparity if that society has endorsed the SAGER guideline due to its collaborative nature and dedication to improving scientific publishing practices. Documentation of the presence of such influence may help to demonstrate the usefulness of tools in community organization; society membership and the gender audit. Should journals consider policy change to account for systematic gender discrimination, which has been shown to be effective previously, gender audits may be used in the future for social change within the institutions of science.

Attitudes and behavior change intentions regarding policy towards gender distribution in the editorial hierarchy or consideration for adoption of guidelines (such as SAGER Guideline) and the EASE Gender Policy Committee [GPC] recommendations will serve as dependent variables. The SAGER guidelines describe simple procedures for improving the coverage of gender issues in scientific articles. The EASE GPC recommendations are a set of standards promoting gender audits that can be used by journal editors in order to identify and correct relevant imbalances in gender representation in the management of their journals. The intervention used in this project included the distribution of: (1) gender audits, (2) SAGER Guidelines, and (3) EASE recommendations. Also measured as an independent variable was membership in an editors' society. This study hypothesized that editors who are members of an editors' society that has already adopted

a gender reporting guideline will be more likely to consider adopting policy changes towards correcting sex and gender disparities in addiction journals. The data from this survey was also used to correlate attitudes with intentions regarding gender balance, completing the third aim of this study.

4. Methods

The research design is made up of four parts. The first involved the identification of gender disparities using gender audits of 54 addiction journals; 27 were members of an editors' society and 27 were not members of an editors' society. The second compared the gender audit data of ISAJE and non-ISAJE member journals. The third part was to measure editors' responses to gender audits, anonymously, by comparing International Society of Addiction Journal Editors (ISAJE) members with non-ISAJE members. This portion of the study yielded inconclusive results because of a low response rate and thus the fourth part of the research was limited to the correlation of attitudes and intentions of the editors-in-chief who responded to the survey from the third part.

The first step in conducting a gender audit was to identify English language member journals of ISAJE as well as a control group of addiction journals not part of ISAJE. A gender audit is a count of the gender of individuals (both paid and volunteer) working throughout the editorial hierarchy of a particular journal. It is conducted to determine the proportions of men and women involved in the full range of a journal's activities. This process involved online searches for the given names of editorial board members, assistant editors, editors-in-chief, and primary and

secondary authors of original research. Gender was determined based on each first name. For gender neutral names, deeper searches were conducted through publicly available professional information to deduce gender. All information collected for the gender neutral names was already publicly available on the journals' home websites, LinkedIn, home academic pages, etc. The only information recorded as a result of the online searches was the person's gender and professional role in the journal. No individuals were contacted during this portion of the study.

There are 30 English-language member journals of ISAJE. Of the ISAJE English-language, member journals, 27 were successfully audited by publically available information. Gender audits were also conducted for 27 other addiction journals that are not members of ISAJE, which were matched in terms of size and recommendation by Substance Abuse Librarians & Information Specialists (SALIS), a network of addiction librarians and libraries. The inclusion criteria were those who fall into the occupational categories listed in the gender audits of the selected journals: Editor-in-Chief, Associate Editors, Editorial Board, and Primary Author and Secondary Authors of original research articles.

After determining the total number of people in each part of the editorial power structure, gender was determined. That information was coded to account for position in the hierarchy and gender. Those numbers were used to calculate basic percentages, thus determining the gender balance of the journal. This data was analyzed to determine where a sample of addiction journals are in regards to their gender balance in the editorial hierarchy. The data analysis used the chi square test to compare ISAJE member journals with non-ISAJE member journals.

The next part of the project was conducted by surveys (produced and managed by Survey Monkey) emailed to each editor-in-chief, attached with a cover letter, the SAGER Guideline, and the EASE GPC Recommendations. Once the gender audits were collected, they were distributed via email to editors in chief of each journal along with an anonymous survey. The goals of the survey were to measure attitudes regarding sex, gender, and sexism in the editorial hierarchy. Of the 54 journals emailed, 27 returned usable surveys; 22 were from ISAJE member journals, and 5 were from non-ISAJE member journals. Membership of the journal or journal editor in an editors' society was considered in evaluating the role of normative organizations on gender equity in journal policies. Finally, attitudes towards consideration of policy changes towards gender equity were measured by questions posed about the editor's willingness to endorse the SAGER guideline.

The target population was the editors-in-chief of each journal included in the study. Editors-in-chief make the final decisions regarding who is hired or appointed as a volunteer to manage the journal. To measure attitudes and behavior, a set of self-report items were rated on a five-point Likert scale to determine where they stand on gender equity in their field. Intentions to follow gender equity guidelines and accept recommendations would lead to the most change in the top tier of the editorial hierarchy. The units of analysis were attitudes and intended behavior regarding gender inequity in the higher levels of the power structure. Editors-in-chief are the head of their respective organizations. By asking the top of the power structure to reflect on the importance of gender equity (intervention), we measured their level of willingness to change (outcome). Another variable is the effects of membership in an

editors' society on support or rejection of the need for gender balance in the editorial power structure. Thus, we conducted gender audits, compared gender audits between ISAJE and non-ISAJE member journals, and contacted ISAJE member editors, as well as equivalent journals not belonging to ISAJE, in the field of addiction. It is important to note that these journals identify as English language journals. This is crucial to the first action step of the proposal, determining gender through conducting gender audits based on first name.

The second part of the analysis was conducted after the surveys were returned. The measurement instrument was a 15 question survey: 2 yes/no questions and 13 Likert scale questions. The questions gauge attitudes and intended behavior regarding gender discrimination in the editorial hierarchy. The survey was developed on an automated, online software application called Survey Monkey. A link for the Survey Monkey survey was distributed in emails to each of the editors-in-chief, along with their respective gender audit results and a cover letter. A follow up reminder was sent twice to all participants.

Chi square tests and a correlation matrix were conducted using SPSS statistics version 22. To test the first hypothesis of this study, a 2 x 2 chi square test was conducted for each level of the editorial hierarchy for all 54 journals. A 2 x 5 chi square was conducted across all 54 journals between male and female vs each position.

This study further hypothesized that there would be less of a gender disparity among journals which are members of an editors' society (ISAJE). The unit of analyses was each journal.

There were insufficient numbers of non-ISAJE member journals received (5 journals responded to the survey after two reminder emails) to match the number of ISAJE member journal response (22 journals responded to the survey). A correlation matrix was computed of the survey results to assess what factors are associated with an interest in gender balance in the editorial hierarchy. This information was used to help explain what kinds of editors might implement gender equity changes.

This study was conducted between January, 2015 and July, 2016. A small sample of gender audits from ISAJE had previously been conducted over the summer of 2015. The results of this sample were presented at the Annual ISAJE Meeting/Conference Budapest, Hungary at the end of August, 2015. Gender audits were conducted throughout autumn of 2015. The Institutional Review Board (IRB) process began in January 2016 and ended with IRB approval in March 2016. A pilot study was conducted in March 2016; distributing 5 surveys to selected editors-in-chief.

5. Results

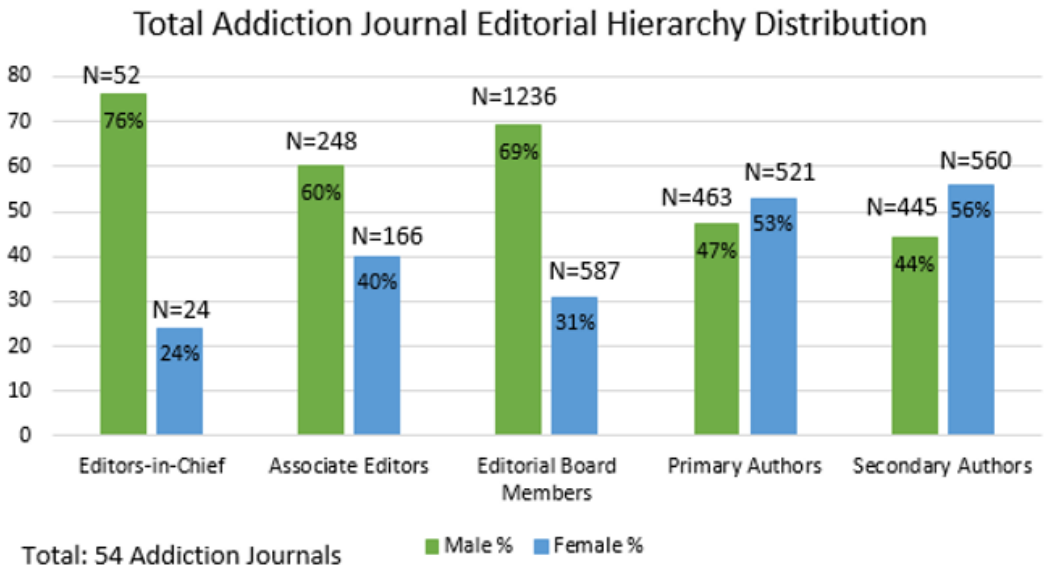
5.1 The Gender Audit Analyses

The first hypothesis was that the gender distribution of a full range of a journal's editorial hierarchy (from authors to the editor-in-chief) will be directly proportional to the power hierarchy and the management of scientific communications.

The gender audit data of the 54 journals, both ISAJE and non-ISAJE members, was analyzed to determine the gender balance. Figure 1 is a bar graph describing the total addiction journal editorial hierarchy distribution, combining both ISAJE and

non-ISAJE member journals. This figure compares females to males on each of the five positions outlined: Editors-in-Chief, Associate Editors, Editorial Board Members, Primary Authors, and Secondary Authors. The results show that the gender gap is larger at the higher levels of the editorial hierarchy, but it is beginning to reverse at the lower end. Chi square statistics were significant for all positions except for primary authors.

Figure 1. Total Addiction Journal Editorial Hierarchy Distribution



5.2 Comparing Gender Audits between ISAJE and Non-ISAJE Member Journals

The second aim of this research was to determine whether membership in an editors' society contributes to a consideration of policy change regarding sex, gender, and sexism in the editorial hierarchy of scientific journals; the prediction was that membership in ISAJE will lead to a more gender balanced editorial hierarchy.

This study hypothesized that editors who are members of an editors' society that has endorsed the Sex and Gender Equity in Research (SAGER) guideline will be

more likely to have a balanced editorial hierarchy than editors who are not members of such a society.

Chi square analysis was used to analyze the gender audit data to compare ISAJE member journals with non-ISAJE member journals (see Table 1). There was no significant difference among editors-in-chief, primary authors, and secondary authors; the p values were 0.480, 0.841 and 0.221, respectively. There was a significant difference among associate editors and editorial board members; the p values were 0.031 and 0.001, respectively. Among non-ISAJE member journals, the difference between male and female associate editors was small; whereas the gender disparity was greater for associate editors for ISAJE member journals. This does not support what was hypothesized. There was a greater disparity in gender among non-ISAJE member journals' editorial board members than in comparison to ISAJE member journals. This does support what was hypothesized.

Table 1. Chi Square and P values from Comparing ISAJE with non-ISAJE Journals

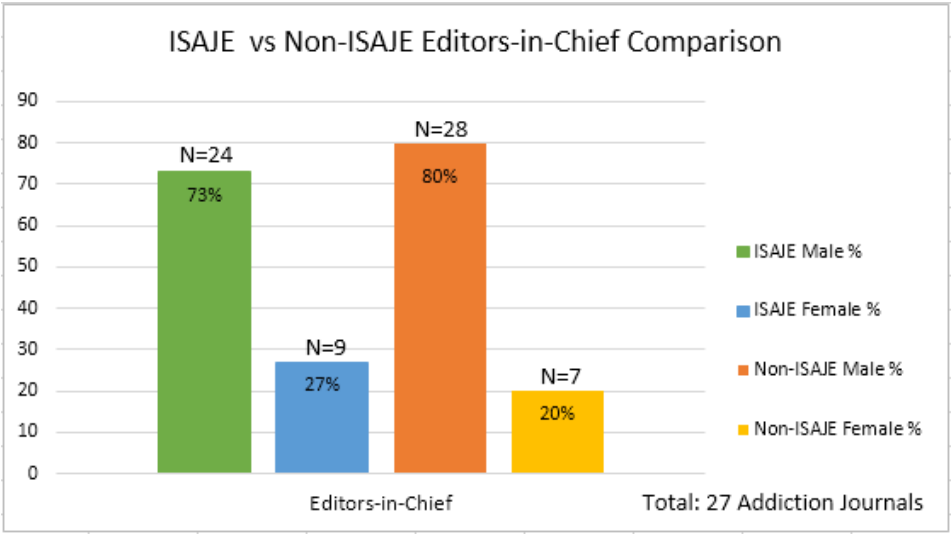
ISAJE vs Non ISAJE	Editors in Chief	Associate Editors	Editorial Board Members	Primary Authors	Second Authors
Chi Square	.499	4.641	11.711	0.040	1.500
P value	0.480	0.031	0.001	0.841	0.221
Sig Y/N	N	Y	Y	N	N

The ISAJE member journal editorial hierarchy distribution in comparison to non-ISAJE member journals is shown in Figures 2-6, comparing females to males on each of the five positions identified previously.

For Editors-in-Chief, ISAJE member journals and Non-ISAJE member journals both have large gender gaps between men and women. Of ISAJE members, 73% of

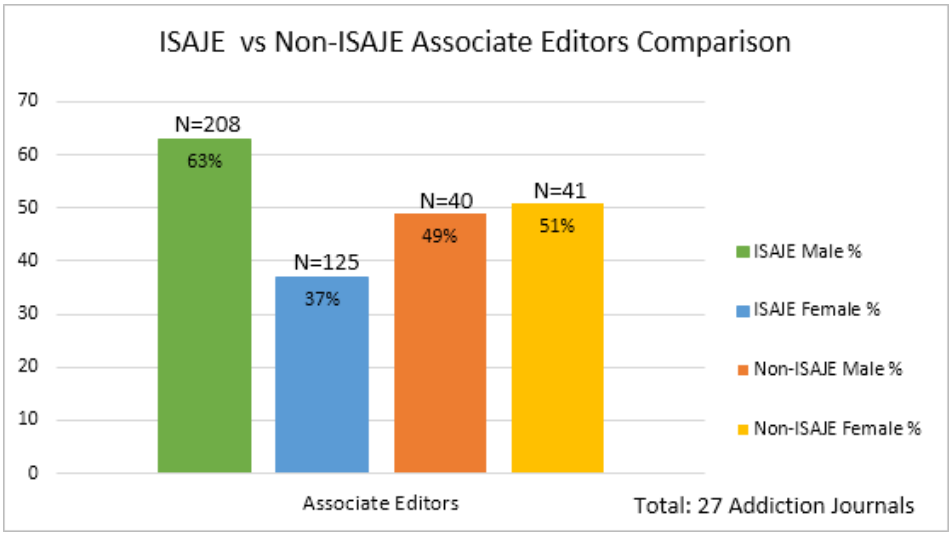
the Editors-in-Chief were men while 27% were women. Of Non-ISAJE members, 80% of the Editors-in-Chief were men while 20% were women.

Figure 2. ISAJE vs Non-ISAJE Editors-in-Chief Comparison



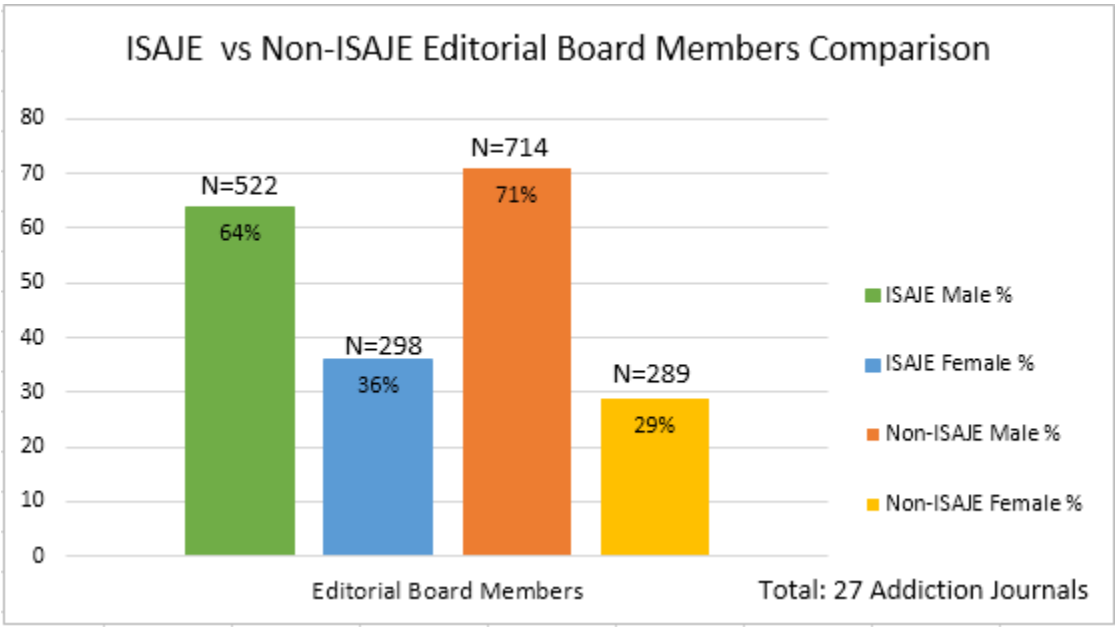
For Associate Editors, ISAJE member journals were found to have a greater gender gap than Non-ISAJE member journals. Of ISAJE members, 63% of Associate Editors were men while 37% were women. Of Non-ISAJE members, 49% of Associate Editors were men while 51% were women.

Figure 3. ISAJE vs Non-ISAJE Associate Editors Comparison



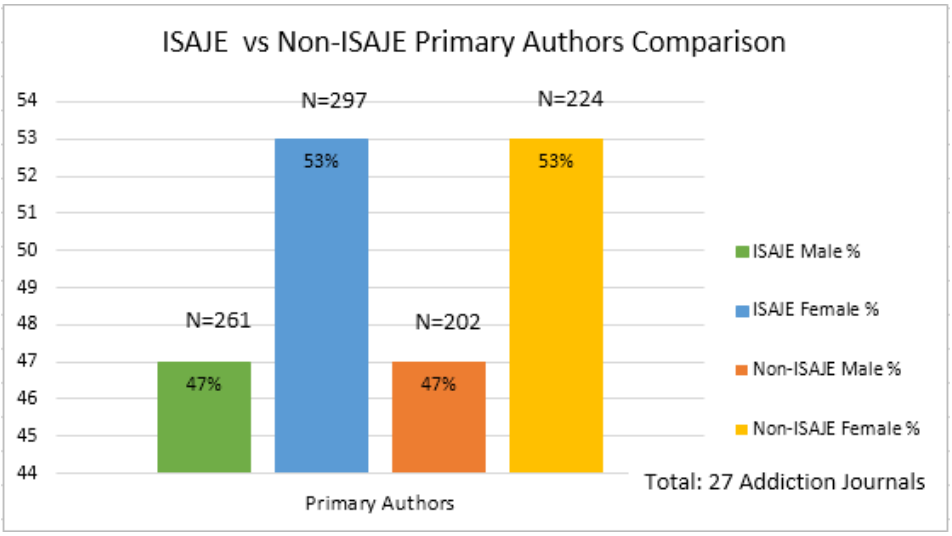
For Editorial Board Members, ISAJE member journals and Non-ISAJE member journals both have large gender gaps between men and women; though the discrepancy is larger for the non-ISAJE journals. Of ISAJE members, 64% of Editorial Board Members were men while 36% were women. Of Non-ISAJE members, 71% of Editorial Board Members were men while 29% were women.

Figure 4. ISAJE vs Non-ISAJE Editorial Board Members Comparison



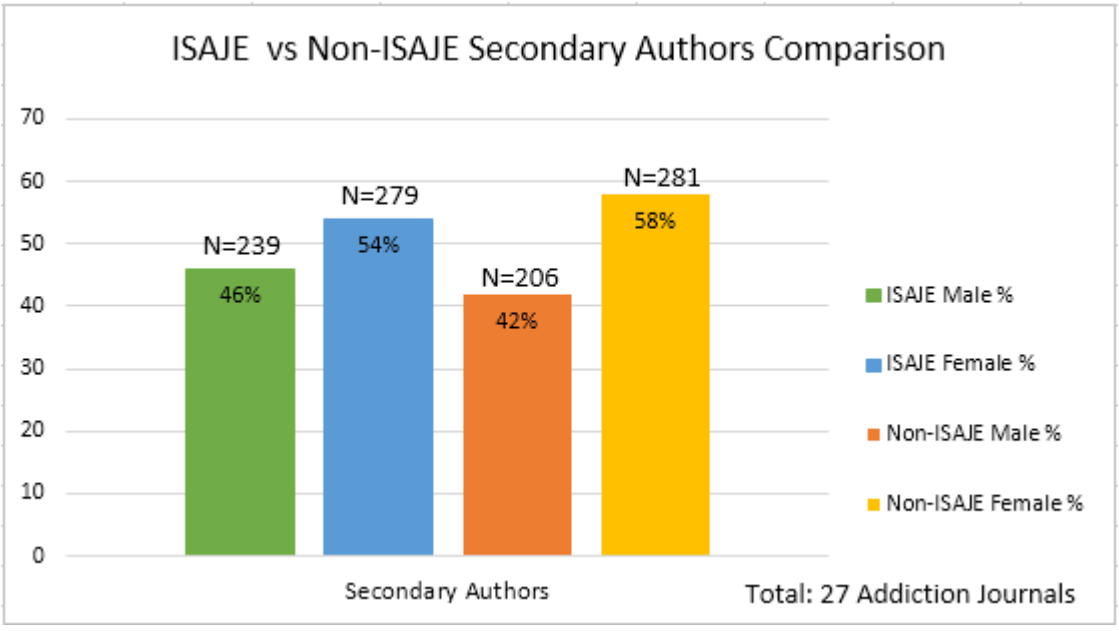
For Primary Authors, ISAJE member journals and Non-ISAJE member journals both have small gender gaps between men and women, favoring women. Of ISAJE and non-ISAJE members, 47% of Primary Authors were men while 53% were women.

Figure 5. ISAJE vs Non-ISAJE Primary Authors Comparison



For Secondary Authors, ISAJE member journals and Non-ISAJE member journals both have small gender gaps between men and women, favoring women. Of ISAJE, 46% of secondary authors were men while 54% were women. Of non-ISAJE journals, 42% of secondary authors were men while 58% were women.

Figure 6. ISAJE vs Non-ISAJE Secondary Authors Comparison



5.3 Survey Data Results and Correlations

Though the development and dissemination of the survey was successful, only 5 non-ISAJE member journals responded. Due to the low response rate, the non-ISAJE member journals will no longer be discussed. The questions displayed in Table 2 on the part of ISAJE editors reflects different types of intentions towards journal policies that would improve gender balance and diminish the gender gap.

Table 2. Average agreement ratings on items measuring endorsement of SAGER Guidelines and gender equity in journal management by ISAJE member journal editors

Likert Scale

1*- Strongly Disagree* ***2****- Disagree* ***3****- Undecided* ***4****- Agree* ***5****- Strongly Agree*

	Editors Society
	N=22
Q5. I intend to recommend the SAGER guidelines for use by authors submitting articles to my journal	3.5
Q8. I support the need to correct gender imbalance in the editorial hierarchy of addiction journals	3.7
Q13. I plan to use the gender audit to make changes in the gender balance of my editorial board	3.1
Q14. I plan to use the gender audit to make changes in the gender balance of my journal's editorial team	3.1
Q15. I will make every effort in my journal to improve gender balance among associate/assistant editors	3.6

The questions exhibited in Table 2 measure attitudes about the need to increase the participation of women as research participants and the need to increase the number of women in research itself. These questions address attitudes about the participation of women. Table 2 exhibits intentions to take action with the respective journals of each editor-in-chief who participated in the survey. The further the means are from 3.0, the more the editors tended to Agree or Strongly Agree on that topic. The closer the means are to 3.0, the more the editors tended to Disagree or Strongly Disagree. It appears that the editors-in-chief were more likely to agree with general

statements than with statements about taking specific actions. Table 3 displays a correlation matrix which correlates the intentions to take action with attitudes. We hypothesize that the more an editor has positive attitudes about the participation of women, the more likely they would be to take these actions (Table 2). The correlations indicate whether the attitudes predict their intention to take action.

Editors-in-chief were more likely to say they would implement the SAGER guidelines (Q5) if they found the SAGER guidelines to be an appropriate model for reporting gender coverage in addiction research (Q4) (r=.767, p= .000). Q12 asks "If a journal has a much higher proportion of women in a particular part of the peer review process (e.g., reviewers, assistant editors), an attempt should be made to increase the number of males to achieve better gender balance". Editors-in-chief were more likely to say they would implement SAGER guidelines (Q5) if they indicated they would increase males to achieve gender balance (Q12) (r= .533, p= .005).

Editors-in-chief were less likely to say they would implement the SAGER guidelines (Q5) if they found the SAGER guidelines to be unnecessary because authors already report the sex and gender of research participants (Q6) (r= -.554, p= .004). They were also less likely to favor implementing the SAGER guidelines (Q5) if they believed gender balance to be a "slippery slope" to more and more unnecessary policies to correct other possible inequities based on personal or social characteristics (e.g., race, country, language, etc.) (Q9) (r= -.459, p= .021).

Editors-in-chief were less likely to support the need to correct gender imbalance in the editorial hierarchy of addiction journals (Q8) if they believed gender balance to be a "slippery slope" (Q9) (r= -.434, p= .027).

Editors-in-chief were more likely to use the gender audit to make changes in the gender balance of their editorial board (Q13) if they agreed there is a need to increase the participation of women in clinical trials and other forms of addiction research (Q3) (r= .508, p= .010). Editors-in-chief were more likely to say they would use the gender audit to make changes in the gender balance of their editorial board (Q13) if they found the SAGER guidelines are an appropriate model (Q4) (r= .425, p= .038). Editors-in-chief were more likely to agree to use the gender audit to make changes in the gender balance of their editorial board (Q13) if they already have a formal or informal gender balance policy (Q11) (r= .603, p= .002). Editors-in-chief- were more likely to use the gender audit to make changes in the gender balance of their editorial board (Q13) if they indicated they would increase males to achieve gender balance (Q12) (r= .744, p= .000).

Editors-in-chief were less likely to agree to use the gender audit to make changes in the gender balance of their editorial board (Q13) if they found the SAGER guidelines to be unnecessary (Q6) (r= -.583, p=.003), if they found gender balance is not relevant to the peer review decision-making process (Q7) (r= -.402, p= .046), and if they found gender balance is a "slippery slope" (Q9) (r= -.587, p= .003).

Editors-in-chief were more likely to agree to use the gender audit to make changes in the gender balance of their journal's editorial team (Q14) if they found the SAGER guidelines are an appropriate model (Q4) (r= .515, p= .008). Editors-in-chief were more likely to agree to use the gender audit to make changes in the gender balance of their journal's editorial team (Q14) if they already have a formal or informal gender balance policy (Q11) (r= .468, p= .018). Editors-in-chief were more

likely to use the gender audit to make changes in the gender balance of their journal's editorial team (Q14) if they indicated they would increase males to achieve gender balance (Q12) (r= .700, p= .000).

Editors-in-chief were less likely to agree to use the gender audit to make changes in the gender balance of their journal's editorial team (Q14) if they found the SAGER guidelines to be unnecessary (Q6) (r= -.457, p= .022) and they believed gender balance is a "slippery slope" (Q9) (r=-.465, p= .019).

Editors-in-chief were more likely to make every effort in their journal to improve gender balance among associate/assistant editors (Q15) if they agreed there is a need to increase the participation of women in addiction research (Q3) (r= .498, p= .010) and if they already have a gender balance policy (Q11) (r= .559, p= .004). Editors-in-chief were more likely to make every effort in their journal to improve gender balance among associate/assistant editors (Q15) if they indicated they would increase males to achieve gender balance (Q12) (r= .587, p= .002).

Editors-in-chief were less likely to make every effort in their journal to improve gender balance among associate/assistant editors (Q15) if they found the SAGER guidelines to be unnecessary (Q6) (r= -.682. p= .000), if they find gender balance is not relevant to the peer review decision-making process (Q7) (r= -.412, p= .037), and if they believed gender balance is a "slippery slope" (Q9) (r= -.483, p= .014). Editors-in-chief were less likely to make every effort in their journal to improve gender balance among associate/assistant editors (Q15) if they believed a scientist's gender has little impact on the way addiction science is conducted or reported (Q10) (r= -.493, .011).

Table 3. Correlation Matrix assessing the factors of association (N= 27 Editors)

	Q5. Implement SAGER		Q8. Support Need and Correct Gender Imbalance in Ed Hierarchy		Q13. Use Audit to Appoint Ed Board members		Q14. Use Audit to Appoint editorial team		Q15. Use Audit to Appoint associate/assistant editors	
Survey Items	**r**	**P**	**r**	**P**	**r**	**P**	**r**	**P**	**r**	**P**
Q3. Need to increase participation of women	.379	.057	.271	.172	**.508**	**.010**	.337	.092	**.498**	**.010**
Q4. SAGER is an appropriate model	**.767**	**.000**	.206	.324	**.425**	**.038**	**.515**	**.008**	.275	.184
Q6. SAGER is unnecessary	**-.554**	**.004**	-.053	.800	**-.583**	**.003**	**-.457**	**.022**	**-.682**	**.000**
Q7. Gender balance is not relevant	-.379	.056	-.338	.084	**-.402**	**.046**	-.375	.059	**-.412**	**.037**
Q9. Gender balance is a "slippery slope"	**-.459**	**.021**	**-.434**	**.027**	**-.587**	**.003**	**-.465**	**.019**	**-.483**	**.014**
Q10. Gender has little impact on science	-.172	.402	-.323	.101	-.385	.058	-.317	.115	**-.493**	**.011**
Q11. My journal has gender policy	.085	.685	.336	.094	**.603**	**.002**	**.468**	**.018**	**.559**	**.004**
Q12. Increase males to achieve gender balance	**.533**	**.005**	.276	.164	**.744**	**.000**	**.700**	**.000**	**.587**	**.002**

6. Discussion

The suggestion that women are not interested in science is not a valid explanation for why there are so few women at the top of the field of science. This study suggests the gender disparity within the peer review structure of scientific journals publishing addiction science is greatest at the higher levels (e.g., editor, assistant editor, editorial advisory board) and smaller at the lowest levels (e.g., secondary and primary authors). The bar graph in Figure 1 displays great disparities between editors-in-chief, associate editors, and editorial board members; those at the higher levels of the editorial power structure. Also shown in Figure 1, there is gender balance among the primary and secondary authors, if not leaning in favor of females. The evidence of gender balance among the primary and secondary authors furthers the notion that women are already in the field of addiction science, writing original research articles. There is no shortage of women in the field and therefore the results suggest that there may be a power structure that does not allow for women to reach the upper echelons of editorial management.

Another explanation that could be considered are age cohort effects. The composition of the upper levels of journal management may reflect the diversity of the field when these experienced professionals were first entering. In a decade, we may see the balance exhibited now by primary and secondary authors move up to editors-in-chief. As the new cohort ages, the gender disparity could disappear.

A systematic barrier different from a power structure may also exist, surrounding the requirements of family care. Women likely lack support regarding maternal and family care as they advance through their careers. With traditional gender roles

potentially still influencing capitalist centered-economies in both developing and developed nations, as well as scientific drive, men may have the advantage to ascend higher management positions. Thus, gender role models and sex differences might favor more males at the higher end as women drop out due to competition for sparse positions or taking time off to raise a family.

The comparison between gender audits for ISAJE and non-ISAJE member journals did not support our original hypothesis. There were significant differences between ISAJE and non-ISAJE member journals among associate editors and editorial board members. An argument could be made that editorial board members are actually higher up the editorial hierarchy than associate editors. Associate editor positions may vary throughout journals as there is higher diversity of entry-level editors and those more accomplished. Editorial boards are generally made up of more experienced professionals, thus contributing their wealth of knowledge from their respective fields as a board member. Those more distinguished and with more experience in the field are usually called upon to join editorial boards. Associate editors are generally those still building experience.

There is less of a disparity, arguably none at all, for those journals not a part of ISAJE. This result could have been the result of a failure to properly match the groups. There is, however, more of a disparity among editorial board members not a part of ISAJE. The disparity among editors-in-chief, primary authors, and secondary authors was not found to be significantly different between ISAJE and non-ISAJE. ISAJE may not provide education or promote its gender balance policy to the extent

we initially hypothesized. Membership in an editors' society advocating for better gender balance was not supported through the findings of this study.

Only 5 non-ISAJE journals returned their surveys, compared to ISAJE's 22 surveys. Thus, results can only be considered suggestive. Nevertheless, the response rate is worth noting in regards to ISAJE membership.

A correlation matrix was conducted to assess the associations between attitudes and intentions regarding gender balance in research participants as well as the editorial hierarchy. Significant associations may help to understand attitudes of editors who may be supportive of SAGER and gender balance issues. The attitude that there is a need to increase participation of women in clinical trials and other forms of addiction research (Q3) correlates with stated intentions towards using the gender audit to make changes in the gender balance of their editorial board (Q13) and intentions to make every effort to improve gender balance among associate/assistant editors (Q15).

The attitude related to finding the SAGER guidelines as an appropriate model for reporting gender coverage in addiction research (Q4) correlates with intentions towards implementing the SAGER guidelines (Q5), using the gender audit to make changes in the gender balance of their editorial board (Q13), using the gender audit to make changes in the gender balance of their editorial team (Q14), and intentions to make every effort to improve gender balance among associate/assistant editors (Q15).

The attitude towards the SAGER guidelines which finds it unnecessary (Q6) was associated with the intention to not implement the SAGER guidelines (Q5) and not to use the gender audit to make changes in the gender balance of their editorial board

(Q13), editorial team (Q14), and associate/assistant editors (Q15). The attitude that gender balance is not relevant (Q7) is associated with the lack of intention to use the gender audit to make changes in the gender balance of their editorial board (Q13) and associate/assistant editors (Q15).

The attitude attributed to finding gender balance to be a "slippery slope" (Q9) is correlated with not intending to implement the SAGER guidelines (Q5), not support the need to correct gender imbalance in the editorial hierarchy of addiction journals (Q8), and not use the gender audit to make changes in the gender balance of their editorial board (Q13), editorial team (Q14), and associate/assistant editors (Q15).

The attitude attributed to believing gender has little impact on science (Q10) was correlated with the intention to not make every effort to improve gender balance among associate/assistant editors (Q15).

The attitude which contributes to already having a gender policy (Q11) was correlated with using the gender audit to make changes in the gender balance of their editorial board (Q13), editorial team (Q14), and associate/assistant editors (Q15).

Q12 asked "If a journal has a much higher proportion of women in a particular part of the peer review process (e.g., reviewers, assistant editors), an attempt should be made to increase the number of males to achieve better gender balance". The attitude attributed to believing an attempt should be made to increase the number of males to achieve better gender balance was associated with intentions to implement the SAGER guidelines (Q5) and using the gender audit to make changes in the gender balance of their editorial board (Q13), editorial team (Q14), and associate/assistant editors (Q15).

7. Conclusions and Recommendations

The gender distribution of a full range of a journal's editorial hierarchy (from authors to the editor-in-chief) is directly proportional to the power hierarchy and the management of scientific communications. While this study does not prove the existence of a power structure, it does reveal a problematic pattern. Women are represented in various fields of science, and for the purposes of this study, they are specifically represented in the addiction field as primary and secondary authors. This study identified one aspect of the issue that they are not reaching the heights of journal management, one dimension of the upper echelons of academia. Previously, it could be claimed there were not enough women in the field to lead to gender balance at the higher levels. This study fills that gap in the literature, establishing that women make up more than half of primary and secondary authors in the addiction field. Regarding the three theories I provided as explanations for this gender imbalance, studies replicating these methods for other fields of science would be helpful in identifying the cause. This would provide a partial solution to the problem of gender imbalance. Editors-in-chief can use the findings of this study to reflect upon their choices for editorial team members.

The results of the comparison of journals belonging to an editors' society with those not members of an editors' society were inconclusive. Not enough journals not belonging to ISAJE responded to the survey. Perhaps with more time to contact editors, the number of responses could have been greater.

Many attitudes were associated with positive outcomes regarding gender balance. Editors were more likely to say they would implement the SAGER guidelines if they found SAGER to be an appropriate guideline and if they indicated they would also increase the number of males to achieve gender balance should there be an imbalance. Editors were less likely to implement the SAGER guidelines if they found the SAGER guidelines to be unnecessary or if they believed gender balance to be a "slippery slope". Thus, a recommendation can be made that the key to successfully implementing the SAGER guidelines across journals would involve clearly demonstrating the benefits of the SAGER guideline.

Editors-in-chief were less likely to support the need to correct gender imbalance in the editorial hierarchy of addiction journals if they believed gender balance to be a "slippery slope". In order to support the need to correct gender balance, editors would need clear and direct briefing on the importance and usefulness of gender balance. A similar recommendation can be made to address the attitudes against using the gender audit to make changes to editorial board members, editorial team, and assistant/associate editors.

8. Limitations

The most significant limitation of this study is that it only included addiction journals. Addiction as an interdisciplinary field may be sociologically more aware and thus have the potential to employ editors-in-chief who are more receptive to gender equity as a policy. However, there are a variety of other social science fields that are worthy of this kind of evaluation using gender audits.

Another important limitation is the determining of gender. While gender accounts for half of the world, other matters of diversity should also be addressed when considering intersectionality: race, ethnicity, socioeconomic status. The method to determine gender is a limitation because social masculine/feminine biases and assumptions of gender are not always correct. Since it is time consuming to check each and every individual on publicly available information in google searches, it is not feasible to be absolutely certain of the gender of each person audited.

Limiting the journals audited and surveyed to English speaking journals is also a limitation. There is much to be learned from journals of other languages regarding culture and status of discrimination against women. Any policy to enhance women's participation in the scientific workforce must take into account the variety of social, cultural, economic and political contexts around the world in which students learn science and perform scientific work.[20] This cannot be addressed unless a variety of journals in different languages are gender audited, as well as examined for sociopolitical history regarding women's inclusion in the field of research.

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Appendix A: EASE GPC RECOMMENDATIONS

Annex 1. Questions intended to raise gender awareness among authors

Research approach:

- ✓ Are the concepts of gender and/or sex used in your research project?
- ✓ If yes, have you explicitly defined the concepts of gender and/or sex? Is it clear what aspects of gender and/or sex are being examined in your study?
- ✓ If no, do you consider this to be a significant limitation? Given existing knowledge in the relevant literature, are there plausible gender and/or sex factors that should have been considered? If you consider sex and/or gender to be highly relevant to your proposed research, the research design should reflect this.

Research questions and hypotheses:

- ✓ Does your research question(s) or hypothesis/es make reference to gender and/or sex, or relevant groups or phenomena? (e.g., differences between males and females, differences among women, seeking to understand a gendered phenomenon such as masculinity)

Literature review

- ✓ Does your literature review cite prior studies that support the existence (or lack) of significant differences between women and men, boys and girls, or males and females?
- ✓ Does your literature review point to the extent to which past research has taken gender or sex into account?

Research methods

- ✓ Is your sample appropriate to capture gender and/or sex based factors?
- ✓ Is it possible to collect data that are disaggregated by sex and/or gender?
- ✓ Are the inclusion and exclusion criteria well justified with respect to sex and/or gender? (Note: this pertains to human and animal subjects and non-organismic biological systems)
- ✓ Is the data collection method proposed in your study appropriate for investigations of sex and /or gender?
- ✓ Is your analytic approach appropriate and rigorous enough to capture gender and/or sex based factors?

Ethics:

- ✓ Does your study design account for the relevant ethical issues that might have particular significance with respect to gender and/or sex? (e.g., inclusion of pregnant women in clinical trials)

Source: Adapted from Canadian Institutes of Health Research.

Appendix B

INSTRUCTIONS: Please respond to each of the following statements by clicking the option which best expresses your opinion regarding that statement.

Rating scale

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- My journal is a member of the International Society of Addiction Journal Editors (ISAJE)
- I find the SAGER guideline to be an effective model for reporting gender coverage
- I intend to adopt the SAGER guideline
- I am considering adopting the SAGER guideline
- I do not believe the SAGER guideline will be useful for my journal
- I plan to recommend the SAGER Guideline to my editorial board
- I intend to write an editorial regarding gender equity in the editorial hierarchy
- I support the need to correct gender imbalance in the editorial hierarchy
- My journal currently enforces a gender balance policy
- I want to publish my own guideline regarding gender equity instructions to authors
- I plan to use the gender audit to make changes in the gender balance of my editorial board
- I plan to use the gender audit to make changes in the gender balance of my journal's editorial team
- I will make every effort in my journal to improve gender balance among authors
- I will make every effort in my journal to improve gender balance among associate/assistant editors
- I will make every effort in my journal to improve gender balance among board members

COMMENTS (Please provide any comments you consider relevant here)

Appendix C

Sex and Gender Equity in Research: Rationale for the SAGER Reporting Guideline and recommended use

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Abstract
Sex and gender differences are often overlooked in research design, study implementation and scientific reporting, as well as in general science communication. This oversight limits the generalizability of research findings and their applicability to clinical practice, in particular for women, but also for men. This article describes the rationale for an international guideline to encourage a more systematic approach to the reporting of sex and gender in research across disciplines. The Sex and Gender Equity in Research (SAGER) guideline is a comprehensive procedure for reporting of sex and gender information in study design, data analyses, results and interpretation of findings. The SAGER guideline is designed primarily to guide authors in preparing their manuscripts but it also encourages editors, as gatekeepers of science, to integrate assessment of sex and gender in all manuscripts as an integral part of the editorial process. The need for the SAGER guideline is based on evidence, summarised in this article, that sex and gender have important implications for health and social welfare.

Introduction

Sex and gender are important determinants of health and well-being. Sex refers to a set of biological attributes in humans and animals that are associated with physical and physiological features including chromosomes, gene expression, hormone function, and reproductive/sexual anatomy.[1] Sex is usually categorized as female or male, although there is variation in the biological attributes that constitute sex and how those attributes are expressed.

Gender refers to the socially constructed roles, behaviours and identities of female, male and gender diverse people.[1] It influences how people perceive themselves and each other, how they behave and interact, and the distribution of power and resources in society. Gender is usually incorrectly conceptualized as a binary (female/male). In reality, there is a spectrum of gender identities and expressions defining how individuals identify themselves and express their gender.

Sex and gender interactions influence health and well-being in a variety of ways. Sex and gender both impact environmental and occupational risks, risk taking behaviours, access to health care, health-seeking behaviour, healthcare utilisation, and perceived experience with health care, and thus disease prevalence and treatment outcome. In addition, it is well-known that pharmacokinetics and pharmacodynamics of pharmaceutical agents differ between sexes, resulting in differential adverse event profiles and further impacting treatment outcomes. Thus sex and gender are critical determinants of health.[2]

The sex and gender bias in the conduct of research

Despite recognition of the importance of sex and gender in most areas of research, important knowledge gaps persist owing to the general orientation of scientific attention to one sex/gender, and because of a misconception that disaggregation of sex does not apply to other living organisms that can be classified by sex.[3–6]

The gap in the representation of women in studies on human subjects has been well documented.[1] A review of cardiovascular treatment trials included in Cochrane Reviews reveals that only 27% of the total trial participants in the 258 clinical trials were women.[7] More importantly, among trials recruiting both men and women, only one third reported a gender-based analysis.[8]

Bias in the inclusion of women in human immunodeficiency virus research has also been reported. A review of selected trials with antiretrovirals published between 1994 and 2011 revealed only 19.2% female participants (Curno et al 2015 submitted). More than 79% of animal studies published in *Pain* over a 10 year period included male subjects only, and only 4% studied sex differences.[9]

The underrepresentation of women in research can result in adverse consequences. Among the 10 prescription pharmaceuticals withdrawn from the US market between 1997 and 2001, eight caused greater harm to women than men.[10] More recently, the US Food and Drug Administration (FDA) issued a safety communication, recommending half a dose of zolpidem for women, due greater susceptibility to the risks of the drug.[11] Sex- and gender-based analysis, in all of these cases, would have provided sufficient information to guide dosing and applicability of drugs in men and women prior to approval.

Failure of gender-sensitive analysis also applies to a range of other disciplines. In the field of engineering, lack of consideration of differences in the physiology and anatomy

of males and females in developing car seats has resulted in higher risk for whiplash injuries among female car occupants compared with men.[12,13]

Although the gender gap has most often been applied to women, the benefit that sex- and gender-based analysis has for our understanding of men's health should also be noted. Despite the increasing sex/gender-balanced representation of subjects in research and reporting of sex-specific data, these examples indicate that existing policies have not been enforced.[3] Lack of interest in sex and gender differences may not only be harmful, it also presents missed opportunities for innovation. Understanding the underlying differences and similarities, exploring applicability, uptake and impact of technological innovations and getting deeper insight into cognitive variability will undoubtedly lead to more innovative approaches and better solutions to meet the needs of society.

The role of journal editors and editorial policies

Editors play an important role as gatekeepers of science, including the articulation of an ethical framework that influences the conduct of research. With an ever-increasing volume of information being published, concerns over the quality of publications have lead journal editors, publishers and professional associations to implement detailed guidelines. Ethical review procedures are now universally applied in human and animal research, in part because of journal requirements. The impact of journal policies on compliance to mandates has been clearly demonstrated in such diverse areas as clinical trial registration[14] and the reporting of systematic reviews after introduction of PRISMA guidelines.[15] Another illustration is the gradual adoption of the Consolidated Standards of Reporting Trials (CONSORT) statement, which has led to improved reporting of randomized controlled trials.[16,17] Following CONSORT and PRISMA, many other reporting guidelines have been developed in recent years, including the ARRIVE guidelines for animal research.[18]

Although policy implementation and enforcement continue to be a critical challenge, journals could play an important role in advancing the quality and transparency of reported data by promoting sex- and gender-specific analysis of research data as a matter of routine. In a 2011 workshop on "Sex-specific reporting of scientific research", convened by the US Institute of Medicine, a number of key issues were identified that journals and journal editors should address in order to improve gender-sensitive reporting of research.[3]

On the basis of the available evidence, a committee of the US Institute of Medicine in 2010 recommended that the International Committee of Medical Journal Editors (ICMJE) and other editors adopt a guideline that all papers reporting the results of clinical trials analyse data separately for men and women. The ICMJE has since published more robust guidance on sex and gender reporting, recommending that researchers include representative populations in all study types, provide descriptive data for sex and other relevant demographic variables, and stratify reporting by sex.[19]

Adequate inclusion of sufficient men and women (and other sub-populations) in research, along with appropriate analysis and transparent and complete reporting of research data require a concerted effort among funders, researchers, reviewers, and editors.[20] Although editors typically enter the research process late, after the research has already been concluded and analysed, they can still play an important role in ensuring effective, transparent and complete sex/gender reporting.

In recent years, several reviews of sex/gender issues in scientific research and its reporting have made recommendations regarding the best ways to address the problems that have been identified. Doull et al.[21,22] proposed that the methodology of systematic reviews and of sex- and gender-based analyses be refined and synchronized to enhance the collection, synthesis, and analysis of evidence for decision making, and they developed a sex/gender appraisal tool for systematic reviews and adapted it to evaluate primary studies and protocols for new research.[22] Nowatski and Grant[23] provided a rationale for gender-based analysis, which is designed to identify the sources and consequences of inequalities between women and men, and to develop strategies to address them. The Clinical Orthopedics and Research (CORR) journal published an editorial on gender and sex in scientific reporting in 2014, including a set of recommendations highlighting that the issue was relatively new to this specialty, so the recommendations are highly encouraged but not a requirement.[5]

Editorial associations, publishing houses, funding agencies and public interest organizations have also taken an interest in sex/gender issues. The Canadian Institutes of Health Research implemented a requirement in 2010 that all grant applicants respond to mandatory questions about whether their research designs include gender and sex.[24] Advances made in the inclusion of women as research participants in the US can be attributed in large part to the actions taken at the NIH in 1993 that stipulated women and minorities should be included in phase 3 clinical trials so that valid analyses of differences in intervention effects could be performed.[25] More recently, the NIH announced plans to require grant applicants to describe how they will balance of male and female cells and animals in preclinical studies, unless sex-specific inclusion is unwarranted.[6]

Despite a greater recognition of the importance of sex and gender considerations in research and scientific publishing, progress has been slow in some areas of science and further work is needed to build on preceding efforts by journals, journal editors and learned societies. As noted by Nieuwenhoven,[26] more vigorous approaches are needed that stimulate scientists to integrate sex and gender aspects into their research. For example, there is no overarching set of recommendations that provides guidelines for better reporting of sex and gender in scientific publication across disciplines. To address this need, the EASE Gender Policy Committee, established in 2012, has developed a set of guidelines for reporting of Sex and Gender Equity in Research (SAGER).

The Sex And Gender Equity in Research (SAGER) reporting guideline

The policies, procedures and recommendations reviewed above have been used as a basis for the SAGER guideline designed to promote a more systematic and complete reporting of sex and gender in research. The guideline provides researchers and authors with a tool to standardize sex and gender reporting in scientific publications. It is also aimed at editors as a practical instrument to evaluate research manuscript and as a vehicle raise awareness among authors and reviewers.

As a general principle, the guideline recommends careful use of the words sex and gender in order to avoid confusing both terms. The use of common definitions will improve the ability to conduct meta-analyses of published and archived data. The term sex should be used as a classification of male or female based on biological distinction to the extent this is possible to confirm. Authors should underline in the methods section whether sex of participants was defined based on self-report, or assigned following external or internal

examination of body characteristics, or through genetic testing or other means. In studies of animals, the term sex should be used. In cell biological, molecular biological, or biochemical experiments, the origin and sex chromosome constitutions of cells or tissue cultures should be stated. If unknown, the reasons should be stated. In other disciplines, such as the testing of devices or technology, authors should explain whether it will be applied or used by all genders and if it has been tested with a user's gender in mind. Table 1 presents a summary of the SAGER guideline. It applies to all research with humans, animals or any material originating from humans and animals (e.g., organs, cells, tissues), as well as other disciplines whose results will be applied to humans such as, for example, mechanics and engineering.

(INSERT TABLE 1 NEAR HERE)

Title and Abstract. If only one sex/gender is included in the study, the title as well as the abstract should specify the sex of animals or any cells, tissues, and other material derived from these, and the sex/gender of human participants. In applied sciences (technology, engineering, etc.), authors should indicate if the study model was based on one sex or the application was considered for use of one specific sex. For studies (of a non-sex-specific issue) in which only one sex has been used, the article's title should specify this fact by including "in males" or "in females" in the title and abstract. If cultures of primary cells, tissue, etc., were obtained from one sex, the sex should be indicated in the title.[3]

Introduction. Authors should report, where relevant, previous studies that show presence or lack of sex or gender differences or similarities. If such studies are lacking, the authors should explain whether sex and/or gender may be an important variant and if differences may be expected.

Methods. Authors should report how sex/gender was taken into account in the design of the study, ensure adequate representation of males and females and justify reasons for the exclusion of males or females. Methodological choices about sex and gender in relation to study population and analytical approach should be reported and justified in the same way as other methodological choices.

In vivo and *in vitro* studies using primary cultures of cells, or cell lines from humans or animals, or *ex vivo* studies with tissues from humans or animals must state the sex of the subjects or source donors, except for immortalized cell lines, which are highly transformed.[3] In other cases, e.g., embryonic or early postnatal cultures, cell lines immortalized from a mixed culture, or previously completed experiments for which sex was not documented, it is recommended that researchers determine the sex of cells or cell lines by chromosomal analysis, and that the designations "mixed" or "unknown" should be used only when the sex cannot be determined through any methods.

Results. Data should be reported disaggregated by sex and an analysis of sex/gender differences and similarities should be described, where appropriate. Anatomical and physiological differences between men and women (height, weight, body mass, cell counts, hormonal cycles, etc.) as well as social and cultural variables (socio-economic status, education, etc.) should be taken into consideration in the presentation of data and/or analysis of the results. We recommend the use of the Gendered innovations' checklist for animals, tissues, cells, and cultures.[27]

If sex/gender-based analyses have been performed, results should be reported regardless of positive or negative outcome. In human studies, data on enrolment, participation, drop-

out, discontinuation and loss-to-follow up should be reported disaggregated by sex/gender, and the influence of sex and gender factors should be assessed *a priori* on the basis of their hypothesized role in the causation, course, treatment effectiveness, and impact and outcome of health problems. Authors should refrain from conducting a *post hoc* gender-based analysis if the study design is insufficient to enable meaningful conclusions. In all cases, raw data should be published disaggregated by sex for future pooling and meta-analysis.

In epidemiological studies, the impact of other exposures, such as socioeconomic variables, on health problems should be examined for all genders, and should be analysed critically from a gender perspective.

Discussion. The implications of sex/gender for the interpretation of study results should be elaborated, including the extent to which the findings can be generalized to all sexes/genders in a population. If no sex/gender-based analyses have been performed, authors should indicate the reasons for lack of such analyses when discussing the limitation of the study and discuss whether such analyses could have affected the results. When interpreting research findings, past research should be examined for both methodological rigor and sex bias in procedure and interpretation. Authors should avoid confusing sex with gender, and reducing complex or interactionist explanations to overly simple ones. Authors should consider all possible explanations for sex/gender-related phenomena including social, cultural, biological, and situational factors, recognizing that many sex-related behaviours might result from either cultural factors or biological factors. Covariation between biology and behaviour does not constitute evidence for physiological causation.

Annex 1 provides a set of questions intended to raise awareness among authors. For many disciplines engaged in original scientific research, this list could serve as a basis for the preparation of a manuscript for submission.

Implementation, adaptation and dissemination

Authors, journal editors, publishers, reviewers and other members of the scientific community all have a role to play in addressing the neglect of the sex and gender dimension in scientific publishing. Editors should make it clear that integration of sex and gender issues makes for more rigorous and ethical science. To the extent that mandates are difficult to implement, we recommend that journal editors endorse the SAGER guideline and adapt it to the needs of their journals and their fields of science. At a minimum, journals publishing original research should request in their instructions to authors that all papers present data disaggregated by sex and, where applicable, explain sex and gender differences or similarities adequately. Figure 1 provides a list of questions that could be used to guide the initial screening of submitted manuscripts. Editors should introduce specific questions in the checklist used to screen initial submissions, as an effort to systematize gender-conscious assessment of manuscripts among editorial staff.

(INSERT FIGURE 1 NEAR HERE)

Editors should distribute the SAGER Guideline to their reviewers and encourage them to use it in the evaluation of manuscripts. They should ensure the manuscript assessment forms completed by peer-reviewers include specific questions regarding the importance and relevance of sex/gender. The following is an example of questions that can be introduced in peer-reviewers' assessment forms:

1. Is sex/gender relevant to the research in question?
2. Have authors adequately addressed sex/gender dimensions, or justified absence of such analysis?

Training the editorial staff on the importance of sex/gender-sensitive reporting should be conducted as part of regular training on ethical conduct and editorial practices.

The SAGER guideline is designed to improve sex and gender reporting of scientific research, serve as a guide for authors, editors and peer-reviewers, be flexible enough to accommodate a wide range of research areas and disciplines, and improve the communication of research findings. To be effective, the guideline needs to be endorsed by a broad cross-section of the scientific community, including journal editors, publishers, editors' societies, professional organizations, scientific advocacy groups, and science journalists and other science communicators. The widest dissemination of the guideline to create increased awareness among all stakeholders is also encouraged.

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Table 1: Sex and Gender Equity in Research (SAGER) guideline

General principles

- Authors should use the terms *sex* and *gender* carefully in order to avoid confusing both terms.
- Care should be exercised in the use of the terms sex/gender to describe methods and explain results in order to avoid confusing both terms.
- Where the subjects of research comprise organisms capable of differentiation by sex, the research should be designed and conducted in a way that can reveal sex-related differences in the results, even if these were not initially expected.
- Where subjects can also be differentiated by gender (shaped by social and cultural circumstances), the research should be conducted similarly at this additional level of distinction.

Recommendations per section of the article

Title and Abstract	If only one sex is included in the study, or if the results of the study are to be applied to only one sex/gender, the title as well as the abstract should specify the sex of animals or any cells, tissues, and other material derived from these, and the sex/gender of human participants.
Introduction	Authors should report, where relevant, whether sex and/or gender differences may be expected.
Methods	Authors should report how sex/gender was taken into account in the design of the study, whether they ensured adequate representation of males and females, and justify the reasons for any exclusion of males or females.
Results	Where appropriate, data should be routinely presented disaggregated by sex. Sex/gender-based analyses should be reported regardless of positive or negative outcome. In clinical trials, data on withdrawals and dropouts should also be reported disaggregated by sex.
Discussion	Discuss the potential implications of sex/gender on the study results/analyses should be discussed. If a gender analysis was not conducted, the rationale should be explained. Authors should further discuss the implications of the lack of such analysis on the interpretation of the results.

Annex 1: Authors' checklist for gender-sensitive reporting

Research approach:

- ✓ Are the concepts of gender and/or sex used in your research project?
- ✓ If yes, have you explicitly defined the concepts of gender and/or sex? Is it clear what aspects of gender and/or sex are being examined in your study?
- ✓ If no, do you consider this to be a significant limitation? Given existing knowledge in the relevant literature, are there plausible gender and/or sex factors that should have been considered? If you consider sex and/or gender to be highly relevant to your proposed research, the research design should reflect this

Research questions and hypotheses:

- ✓ Does your research question(s) or hypothesis/es make reference to gender and/or sex, or relevant groups or phenomena? (e.g., differences between males and females, differences among women, seeking to understand a gendered phenomenon such as masculinity)

Literature review

- ✓ Does your literature review cite prior studies that support the existence (or lack) of significant differences between women and men, boys and girls, or males and females?
- ✓ Does your literature review point to the extent to which past research has taken gender or sex into account?

Research methods

- ✓ Is your sample appropriate to capture gender and/or sex-based factors?
- ✓ Is it possible to collect data that are disaggregated by sex and/or gender?
- ✓ Are the inclusion and exclusion criteria well justified with respect to sex and/or gender? (Note: this pertains to human and animal subjects and biological systems that are not whole organisms)
- ✓ Is the data collection method proposed in your study appropriate for investigations of sex and /or gender?
- ✓ Is your analytic approach appropriate and rigorous enough to capture gender and/or sex-based factors?

Ethics:

- ✓ Does your study design account for the relevant ethical issues that might have particular significance with respect to gender and/or sex? (e.g., inclusion of pregnant women in clinical trials)

Source: Adapted from Canadian Institutes of Health Research.